CHAPTER 5.
STRUCTURES

Section 1. TYPES OF STRUCTURES

5-1. General.

This chapter provides guidance for maintaining structures that are a part of the trackage system and some that may affect railroad operations. Bridges, trestles, and box culverts are used for water crossings, pedestrian walkways, roadways, other tracks, and drainage systems. Tunnels and cuts are used to penetrate hills or pass under bridges and other structures. The ensuing paragraphs of this chapter describe effective, preventive maintenance and/or the corrective measures appropriate for the several types of deficiencies usually encountered.

5-2. Supporting Substructures.

Bridges, trestles, and buildings shall be inspected using designated procedures and checkpoints. Supporting structures for elevated cranes should be inspected following each crane load test when cranes are load tested to 125 percent or more of the manufacturer's rated capacity. Inspection reports shall be reviewed and random observations made of rail supports, connections, braces, and beam to column joints for indications of movement, deterioration, or stress. Broken and defective components shall be scheduled for rapair or replacement. For wood, steel or concrete columns, beams, braces, girders, and other structural members, indications of settlement, misalignment, or deflection shall be recorded. Deflection, movement, or settlement under routine in-service loading exceeding established limits shall be investigated, analyzed, the degree of damage documented, and the classification of hazard determined. Structural conditions leading to a critical or catastrophic category of a section of trackage shall be based on a review of the structural analysis and on a condition survey conducted by competent engineers in sufficient detail to establish the safety of the structure.

Section 2. MAINTENANCE OF STRUCTURES

5-3. Bridges and Culverts.

Railroad bridges may be constructed of steel, concrete, masonry, or wood. Steel bridges may be through-truss, through-panel girders, deck truss, or deck panel girder types. These bridges may be open deck or ballasted deck. As far as the bridge structure is concerned, maintenance procedures are generally the same for all types. However, track maintenance will differ between the open deck and ballasted deck bridges.

5-3.1. Open Deck Trackage. On open deck trackage, bolts that secure the ties to the stringers may work loose as the bearing areas of the ties on the stringers become worn, as the ties swell and shrink with moisture changes, or as rot or insect damage develops. Loose bolts on a number of adjacent ties can result in excessive gage and alignment deficiencies. Figure 5-1 shows an open deck pile trestle specially designed for dumping hopper bottom dump cars.

5-3.2. Ballasted Deck Trackage. Ballasted deck trackage is maintained in the same manner as on a regular roadbed. The only extra maintenance required in the trackage is to keep the drainholes unplugged and free draining (Figure 5-2).

5-4. Guardrails.

On structures and approaches, guardrails are installed to guide equipment and prevent it from leaving the rail. Maintaining guardrails in first class condition requires that loose spikes be replaced or redriven, broken tie plates be replaced, and joint bars and track bolts be tightened. These maintenance operations should be performed at least quarterly on heavily used trackage.

5-5. Expansion and Bearing Assemblies.

All expansion joints must be maintained clean and free of incompressible material, which, when struc-

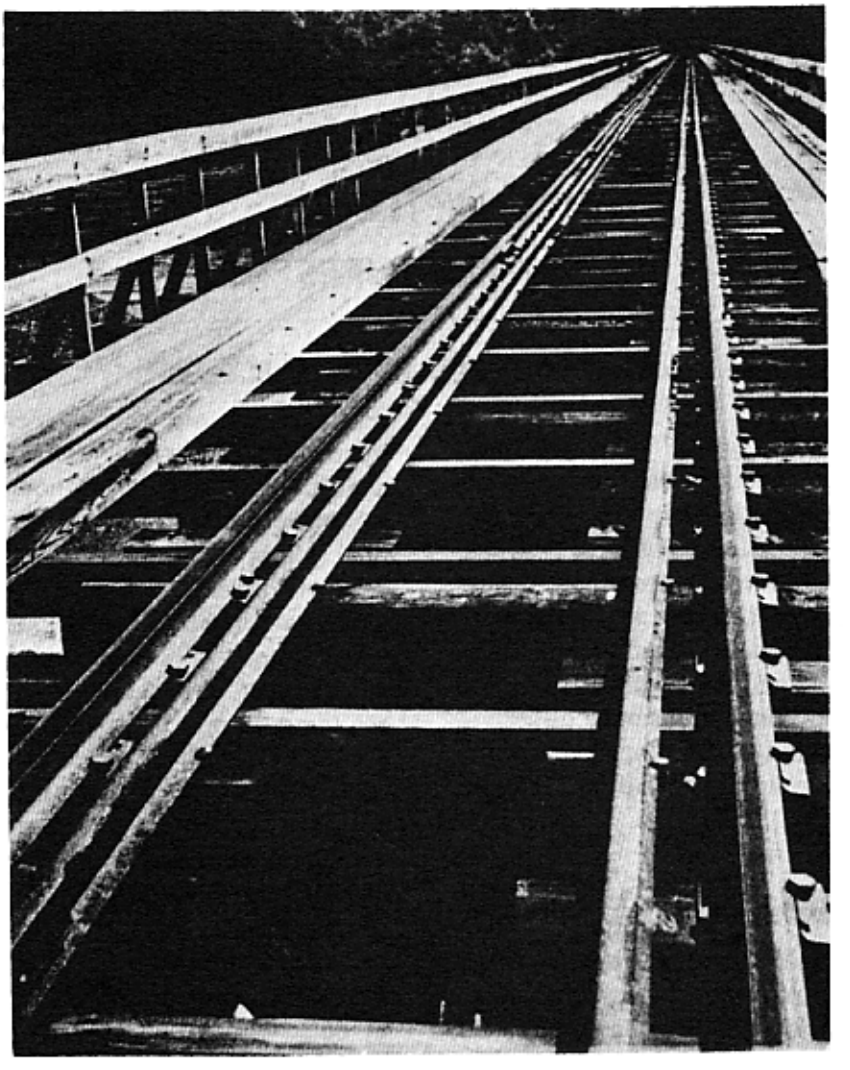

Figure 5–1. Open deck pile trestle (special).

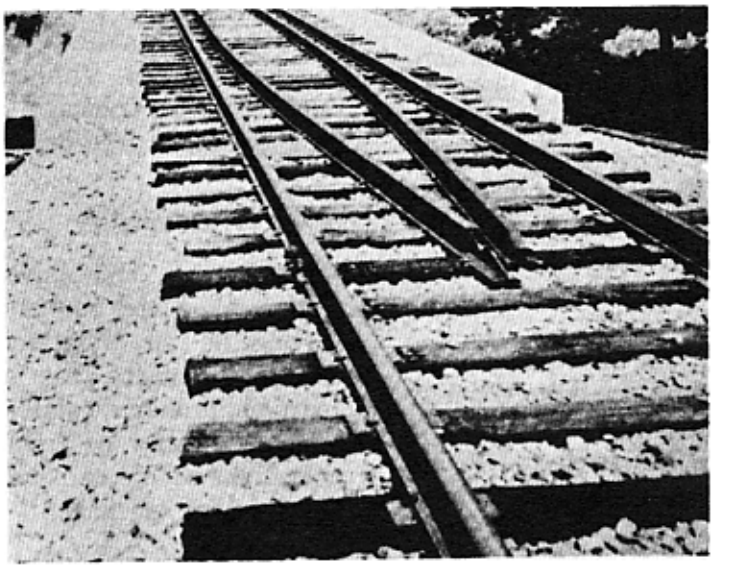

Figure 5–2. Ballast deck trackage.

tures expand, could cause stresses exceeding design capability. Bearing assemblies must be kept clean and well lubricated. Bearing assemblies and expansion joints should be lubricated and/or cleaned annually or semiannually.

5–6. Corrosion.

For those metal portions of trackage structures, the most common form of preventive maintenance is periodic painting. Effective painting requires proper preparation of the surfaces to be painted and the use of proven primers and/or paints. For metals in normal environments, a nominal cleaning with hand or power tools should provide adequate preparation for painting. Where surfaces are subject to corrosive environments (industrial or marine), abrasive blast coatings should be applied immediately to the carefully prepared and cleaned surface. The most corrosion-resistant top coating for such surface is a vinyl paint conforming to DOD Interim Specification VR-3 or VR-6. What type and how many coats to apply will depend on the condition of the existing surface and coating and on the frequency at which it is repainted. (Refer to Paints and Protective Coatings Manual TM 5–618, AFM 85–3, and MO–110.)

5–7. Structure Drainage.

Periodic inspection of the weepholes near the bases of structures will reveal those that have become plugged and ineffective. A small wrecking bar or smaller tool should be sufficient to unplug the weepholes. The following measures should be taken for weepholes that frequently become plugged. If the plugging material is earth, sand, or debris carried into the hole from behind the structure, a screen should be inserted at the rear of the weephole. To prevent plugging of the weepholes by animals or birds who enter from the front face of the structure, a screen should be placed across the front of the hole.

5–8. Concrete Structures.

The most effective preventive maintenance for concrete structures is waterproofing the surface. Both cementitious and bituminous coatings are used for this purpose. Both provide a degree of waterproofing that tends to minimize or eliminate the absorption of moisture that can result in concrete deterioration. Where color is a consideration, bituminous coatings are not used.

5–8.1. Repair of Concrete Structures. The repair of structural concrete requires careful preparation. The best concrete used for such repair will be ineffectual unless it is applied to sound, properly prepared concrete in the original structure. All deficient concrete must be removed to expose hard, strong material. The area to be repaired must be cleaned (may require washing with acid and water) and kept clean until the application of the repair material.

5–8.2. Materials for Repairs. Concrete for repairs may be Portland cement concrete or a system of epoxy resin grout and concrete. The depth and extent of the needed repair, the environment to which the repaired structure is subjected, the required flexibility, and the time available for making the repair determine whether conventional Portland cement concrete or the epoxy system is to be used. Relatively thin concrete repairs or patches of limited extent can best be accomplished with the more expensive epoxy system. Deep repairs of large extent are usually accomplished with Portlant cement concrete which, incidentally, takes longer to attain its design strength.

5–9. Trestles.

To the maximum possible degree, all wood should be prefabricated before being pressure treated. All dimensions of individual members shall be anticipated, including the locations and sizes of all holes to be drilled in each member (Figure 5–3). Rot, insects, and marine borers can be expected to attack wood where it has been cut or drilled in the field. Field-applied preservatives at such points are mandatory but are not as effective as pressure-applied preservatives. Preventive maintenance for wood structures includes periodic checking and renewal of surface-applied preservatives. Exposed cutoffs, daps, and recesses cut into piling and timber are especially vulnerable. Cutoff pile tops are frequently covered with flexible fabric or metal so as to shed rain. Timber trestles, piling, and other wood structures should be examined for soundness by boring with an auger when deterioration is suspected or when necessary to make an engineering analysis.

5–10. Undercutting.

When scour develops into undercutting of structure footings and foundations, immediate and effective corrective measures must be taken to prevent loss of the entire structure. An engineering analysis should be undertaken to determine the scope of safe and proper repair.

5–11. Structure and Approach Trackage

Adequate and effective maintenance of trackage on structures and structure approaches is as essential as the maintenance of the structures. Poor trackage maintenance can cause excessive vibration and undue stresses in structures and can result in disastrous derailments.

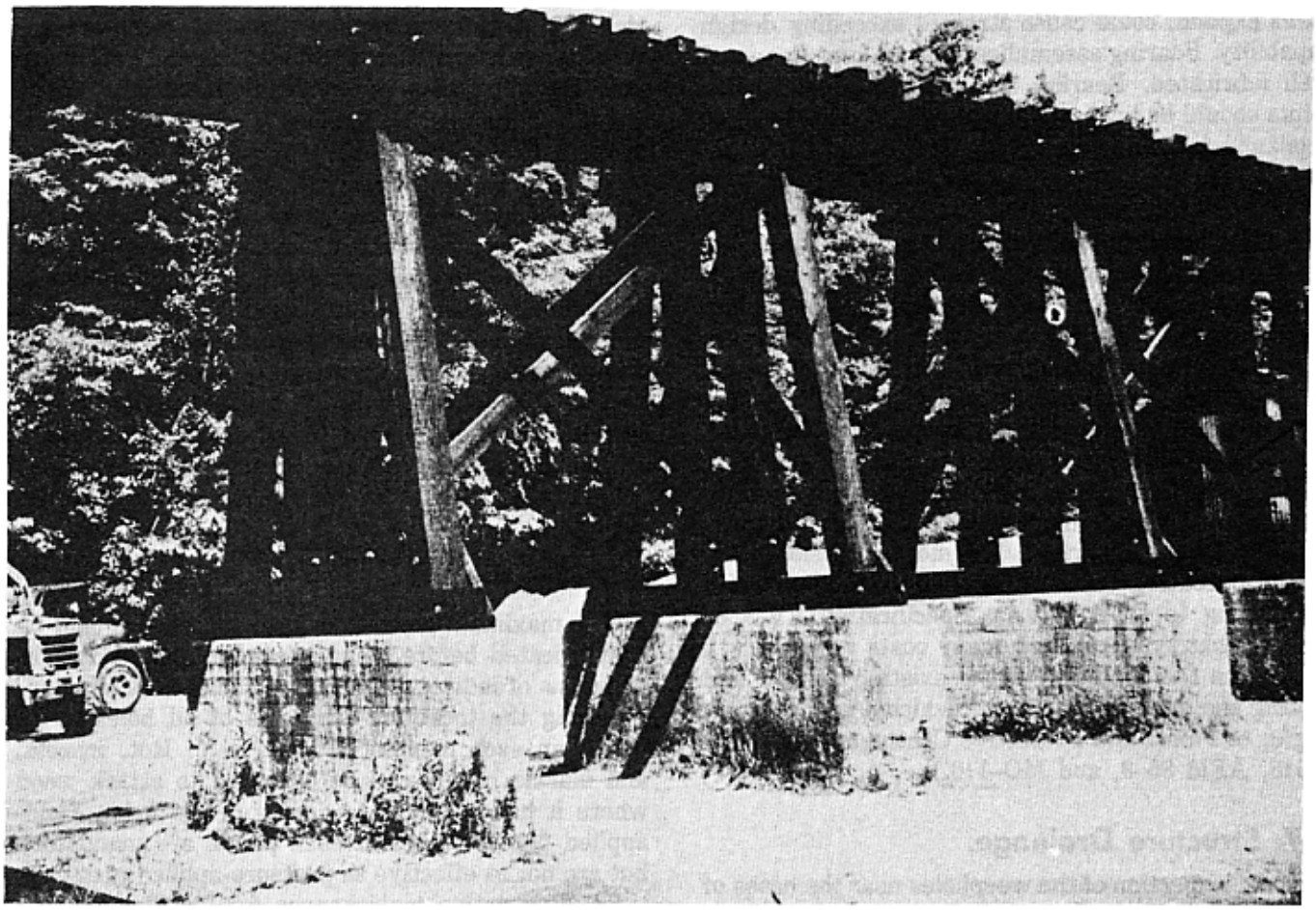

Figure 5–3. Trestle on concrete piers.